UNDER the title, "Neue Gedanken zur Vererbungsfrage," the original German text of the article by Dr. Weismann in the *Contemporary Review* for September, has been published by Gustav Fischer, Jena. The article was a reply to one by Mr. Herbert Spencer, in the *Contemporary* of October 1894, and was written at the beginning of this year; but the time taken to translate it into English caused its publication to be delayed until September.

THE Cambridge University Press will publish in a few weeks a comprehensive work on "Ethnology," by Prof. A. H. Keane. The work is divided into two parts, the first dealing with those fundamental problems which affect the human family as a whole, the second discussing those general questions which concern the primary human groups. Evolutionary principles are taken as the basis of construction throughout the work.

THE "Live Stock Journal Almanac" for 1896 has been published by Messrs. Vinton and Co. It contains an abundance of information on all points connected with the breeding and management of live stock, and is plentifully illustrated. Among the articles we notice "Feeding Pastures," by Mr. W. Carruthers, F.R.S.; "Factors in Horse Breeding," by Captain M. H. Hayes; and "Four Feathered Friends," by Mr. A. F. Lydon. The last-named article will do good by showing agriculturists the usefulness of the linnet, chaffinch, goldfinch, and yellow-hammer.

SEVERAL valuable papers on fruit-growing appear in the *Journal* of the Royal Horticultural Society (vol. xix. part 2, November). M. Charles Baltet, President of the French Pomological Congress, describes the principal points connected with the cultivation of fruit in France, and enumerates the principal varieties recommended to fruit-growers, whether amateurs cultivating for home consumption, or farmers for commercial purposes. At a conference held in September, Mr. G. Bunyard described a number of fruits recently brought to the front; Mr. A. H. Pearson gave a paper on pruning fruit-trees; and a prize essay on the commercial aspect of hardy fruit-growing was read. It may be remembered that in the early spring of this year, the Society offered a prize of £10 for the best essay on this subject. Two essays were selected as of equal merit, and the prize, increased by £5, was divided between the authors, Mr. Lewis Castle and Mr. S. T. Wright. Both these essays are printed in full in the *Journal* before us, and we have no doubt that they will give an effective impulse to the cultivation of fruit in this country.

THE additions to the Zoological Society's Gardens during the past week include a Moor Monkey (*Macacus maurus*, ♀) from the East Indies, presented by Mr. Granville Bantock; a Macaque Monkey (*Macacus cynomolgus*, ♂) from India, presented by Mr. Charles Henderson; three American Jabirus (*Mycteria americana*) from the Island of Marajo, North Brazil, presented by Mr. H. A. Astlett; a Spotted Eagle Owl (*Bubo maculosa*) from East Pondoland, South Africa, presented by Mr. R. W. Murray; a Woodcock (*Scolopax rusticula*), British, presented by Mr. Charles Smoothy; two Alligators (*Alligator mississippiensis*) from the Mississippi, presented by Mr. J. Palmer; a Hoary Snake (*Coronella cana*) from South Africa, presented by Mr. J. E. Matcham; a Macaque Monkey (*Macacus cynomolgus*, ♂) from India, a Leopard Tortoise (*Testudo pardalis*) from South Africa, deposited; a Black-necked Stilt Plover (*Himantopus nigricollis*) from South America, nine Long-eared Sun Fish (*Lepomis auritus*), five Rock Bass (*Ambloplites rupestris*), six Catfish (*Amiurus catus*) from North America, a Reeves's Terrapin (*Clemmys reevesi*) from China, two Red-headed Pochards (*Fuligula cerina*), European, purchased.

OUR ASTRONOMICAL COLUMN.

COMETS BROOKS AND PERRINE.—The following ephemeris for Comet Brooks, for Berlin midnight, is by Dr. Berberich (*Ast. Nach.*, 3321):—

	R.A. h. m. s.	Decl. ° ′
Dec. 19 ...	5 8 5 ...	+67 59·0
20 ...	4 50 45 ...	68 27·9
21 ...	34 19 ...	68 47·3
22 ...	18 56 ...	68 58·9
23 ..	4 4 39 ...	69 4·2
24 ...	3 51 30 ...	69 4·5
25 ...	39 29 ...	69 0·9
26 ...	3 28 33 ...	+68 54·2

Comet Perrine is now moving northwards, and is becoming more favourably placed for observation, as shown in the following extract from Dr. Lamp's ephemeris for Berlin midnight (*Ast. Nach.*, 3322):—

	R.A. h. m. s.	Decl. ° ′	Brightness.
Dec. 19 ...	18 31 25 ...	−30 18·4 ...	57·0
20 ...	43 16 ...	29 16·0	
21 ...	52 14 ...	28 6·0 ...	35·3
22 ...	18 59 0 ...	26 55·6	
23 ...	19 4 8 ...	25 47·3 ...	20·4
24 ...	8 6 ...	24 42·6	
25 ...	11 16 ...	23 42·1 ...	12·3
26 ...	19 13 53 ...	−22 45·4	

The brightness on November 18 is taken as unity.

A NEW OBSERVATORY.—We learn from *Science* that the Legislature of Minnesota has granted £2000 for the erection of a student's observatory at the University of Minnesota. The building is already under roof, and is promised for use by January 1, 1896. The equipment will include a 10-inch equatorial of 150 inches focal length. This instrument is to have a triple objective, one combination of which will form the visual telescopic objective, and another the photographic objective. A spectroscope and photograph measuring machine are among the accessories soon to be added. Upon the completion of this working observatory, Prof. Leavenworth will use it to carry on advanced instruction in astronomy.

PHOTOGRAPHY OF MINOR PLANETS.—Dr. Max Wolf, who has taken a prominent part in the detection of new minor planets by the trails which they leave on a photographic plate during a long exposure, describes his method of work in some detail in *Ast. Nach.*, 3319. His photographic telescope consists of a 6-inch portrait lens of 30 inches focal length, and giving a field of about 70 square degrees. In order to distinguish between true planetary trails and defects of the plates, two photographs of each region are taken, the necessary exposures usually not being more than two hours. One of the best methods of detecting differences between two photographs of the same region is to compare a positive with a negative, the films being in contact; the two trails will then be seen in continuation of each other if they are real. Another method of detecting the trails readily is to employ a stereoscope for viewing the two photographs, the change of position bringing out the planet in relief. As might be expected from the instrument employed, measurements of the photographs do not furnish positions with any great degree of accuracy, but they serve as a guide to observers using instruments of greater precision.

It is somewhat remarkable that Dr. Wolf has not telescopically observed any one of the numerous planets which he has discovered by the photographic method.

SHORT PERIOD VARIABILITY.—The recent researches on the spectra of short-period variable stars, more especially of δ Cephei, have no doubt led many to inquire into the possible explanations of the phenomena observed. Among others, Mr. A. W. Roberts, an assiduous observer of this type of variable in the southern hemisphere, has given attention to the subject (*Astrophysical Journal*, November, p. 283). Omitting the Algol variables, which are perhaps sufficiently explained by eclipses, and β Lyræ, which may provisionally be considered as a special case, any satisfactory theory must explain the relative rapidity of the rise to maximum, continuity of variation throughout the period, and the small range of the light changes. In the case of δ Cephei, Belopolsky has shown that the variability is intimately connected with its revolution, the star being apparently

associated with a relatively dark body; and it is perhaps allowable to suppose a similar connection in the case of other variables of the same class. Besides the possibility of eclipses, this orbital movement may operate in two other ways to produce light changes. If the companion be a dark body, there will be phases depending upon its varying reflection of light from the primary, but the changes of magnitude due to this cause will be practically negligible. When the orbit is very eccentric, as in δ Cephei, the temperature of the companion will vary very considerably at different parts of the revolution, and Mr. Roberts seems to regard its consequent changes of brightness as probably the main cause of the variability. It is admitted, however, that the variations of 1·5 or 2 magnitudes, which are occasionally met with, cannot be satisfactorily explained in this way, and it is necessary to suppose an additional variation of the primary itself due to disturbances at periastron. In the variables, like η Aquilæ, which show a secondary minimum, it is only necessary to suppose that an eclipse also takes place. Attention is drawn to two tests of this theory. First, the companion should show itself spectroscopically at the quadrature following periastron; second, telescopic double stars having highly eccentric orbits should exhibit fluctuations of magnitude depending upon the distance between the components. It should be remembered that there is as yet no evidence of luminosity of the companion to δ Cephei, but it may be that the exposures given to the spectrum photographs have been insufficient to depict it.

THE NEW MINERAL GASES.[1]

AS Mr. Crookes has now published (*Chemical News*, August 23, 1895), the wave-lengths of the lines in the spectra of the new mineral gases observed by him in the tubes supplied by Prof. Ramsay, I propose in the present paper to bring together some notes I have made (some of them some time ago) on the same subject.

The researches made at Kensington in connection with the new gases obtained from bröggerite and other minerals has consisted, to a large extent, of comparisons of the lines in their spectra with lines in the spectra of the sun and stars. Preliminary accounts of these comparisons have already been given, and they show that the bright yellow line seen in the gas from bröggerite is by no means the only important one which appears.

Although the general distribution and intensities of the lines in the gases from bröggerite and cleveite sufficiently corresponded with some of the chief "unknown lines" in the solar chromosphere and some of the stars to render identity probable, it was desirable to see how far the conclusion is sustained by detailed investigations of the wave-lengths of the various lines.

The Yellow Line λ 5875·9.—Immediately on receiving from Prof. Ramsay, on March 28, a small bulb of the gas obtained from cleveite, a provisional determination of wave-length was made by Mr. Fowler and myself, in the absence of the sun, by micrometric comparisons with the D lines of sodium, the resulting wave-length being 5876·07 on Rowland's scale. It was at once apparent, therefore, that the gas line was not far removed from the chromospheric D_3, the wave-length of which is given by Rowland as 5875·98.

The bulb being too much blackened by sparking to give sufficient luminosity for further measurements, I set about preparing some of the gas for myself by heating bröggerite *in vacuo*, in the manner I have already described. A new measurement was thus secured on March 30 with a spectroscope having a dense Jena glass prism of 60°; this gave the wave-length 5876·0.

On April 5, I attempted to make a direct comparison with the chromospheric line, but though the lines were shown to be excessively near to each other, the observations were not regarded as final.

Prof. Ramsay having been kind enough to furnish me, on May 1, with a vacuum tube which showed the yellow line very brilliantly, a further comparison with the chromosphere was made on May 4. The observations were made by Mr. Fowler, in the third order spectrum of a grating having 14,438 lines to the inch, and the observing telescope was fitted with a high power micrometer eye-piece; the dispersion was sufficient to easily show the difference of position of the D_3 line on the east and west limbs, due to the sun's rotation. Observations of the chromosphere were therefore confined to the poles.

During the short time that the tube retained its great brilliancy, a faint line, a little less refrangible than the bright yellow one, and making a close double with it, was readily seen; but afterwards a sudden change took place, and the lines almost faded away. While the gas line was brilliant, it was found to be "the least trace more refrangible than D_3, about the thickness of the line itself, which was but narrow" ("Observatory Note Book"). The sudden diminution in the brightness of the lines made subsequent observations less certain, but the instrumental conditions being slightly varied, it was thought that the gas line was probably less refrangible than the D_3 line by about the same amount that the first observation showed it to be more refrangible. Giving the observations equal weight, the gas line would thus appear to be probably coincident with the middle of the chromospheric line, but if extra weight be given to the first observation, made under much more favourable conditions, the gas line would be slightly more refrangible than the middle of the chromosphere line.

Pressure of other work did not permit the continuation of the comparisons. In the meantime, Runge and Paschen announced (NATURE, vol. lii. p. 128) that they also had seen the yellow line of the cleveite gas to be a close double, neither component having exactly the same wave-length as D_3, according to Rowland.

They give the wave-length of the brightest component as 5878·883, and the distance apart of the lines as 0·323.

This independent confirmation of the duplicity of the gas line led me to carefully re-observe the D_3 line in the chromosphere for evidences of doubling. On June 14 observations were made by Mr. Shackleton and myself of the D_3 line in the 3rd and 4th order spectra under favourable conditions; "the line was seen best in the 4th order, on an extension of the chromosphere or prominence on the north-east limb of the sun. The D_3 line was seen very well, having every appearance of being double, with a faint component on the red side, dimming away gradually; the line of demarcation between the components was not well marked, but it was seen better in the prominence than anywhere else on the limb" ("Observatory Note Book").

It became clear, then, that the middle of the chromosphere line, as ordinarily seen, and as taken in the comparison of May 4, does not represent the place of the brightest component of the double line, so that exact coincidence was not to be expected.

Though the observations are not yet quite completed, the circumstance that the line is double in both gas and chromosphere spectrum, in each the less refrangible component being the fainter, taken in conjunction with the direct comparisons which have been made, render it highly probable that one of the gases obtained from cleveite is identical with that which produces the D_3 line in the spectrum of the chromosphere.

Other observers have since succeeded in resolving the chromospheric line. On June 20, Prof. Hale found the line to be clearly double in the spectrum of a prominence, the less refrangible component being the fainter, and the distance apart of the lines being measured as 0·357 tenth-metres (*Ast. Nach.*, 3302).

The doubling was noted with much less distinctness in the spectrum of the chromosphere itself on June 24. Prof. Hale points out that Rowland's value of the wave-length (as well as that of 5875·924, determined by himself on June 19 and 20) does not take account of the fact that the line is a close double.

Dr. Huggins, after some failures, observed the D_3 line to be double on July 10 (*Ast. Nach.*, 3302); he also notes that the less refrangible component was the fainter, and that the distance apart of the lines was about the same as that of the lines in the gas from cleveite, according to Runge and Paschen.

It may be added, that in addition to appearing in the chromosphere, the D_3 line has been observed as a bright line in nebulæ by Dr. Copeland, Prof. Keeler, and others; in β Lyræ and other bright line stars; and as a dark line in such stars as Bellatrix, by Mr. Fowler, Prof. Campbell, and Prof. Keeler. In all these cases it is associated with other lines, which, as I shall show presently, are associated with it in the spectra of the new gases.

The Blue Line, λ 4471·8.—A provisional determination on April 2 of the wave-length of a bright blue line, seen in the spectrum of the gases obtained from a specimen of cleveite,

[1] "On the New Gases obtained from Uraninite. (Sixth Note.)" By J. Norman Lockyer, C.B., F.R.S. Received at the Royal Society, September 10, read November 21.